Predicting safe sandwich production

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Predicting safe sandwich production

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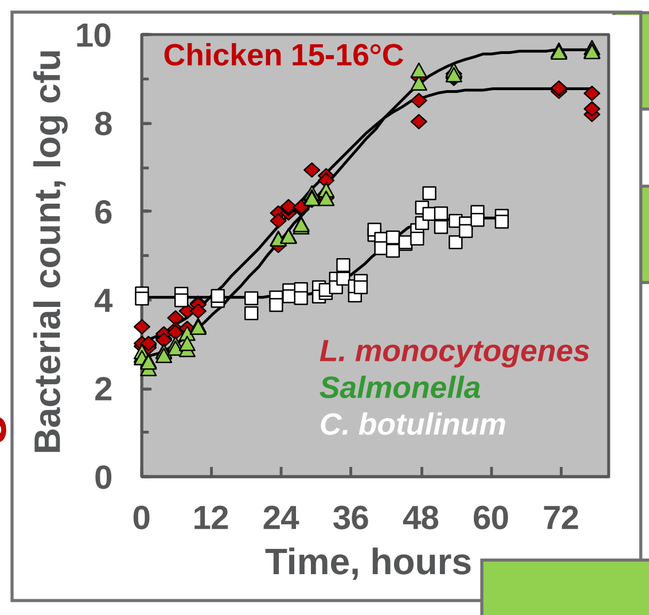
Have you ever experienced that 3 hours was not enough time to prepare, distribute and serve ready-to-eat sandwiches? If yes, this decision support tool might be for you. The tool helps you to control sandwich production by predicting growth of foodborne pathogens.

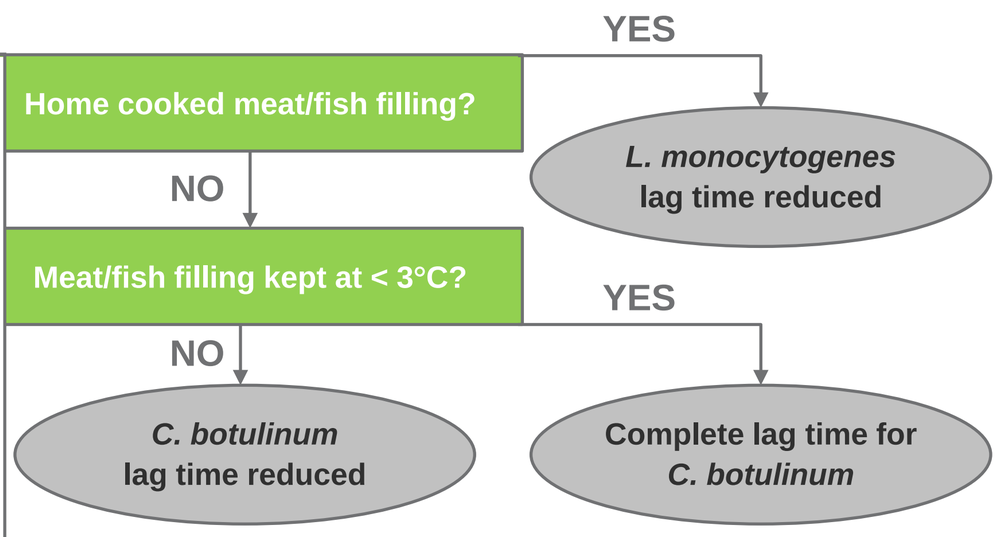
Using time/temperature measurements obtained during preparation, in combination with information on prehistory of the ingredients as well as the expected time/temperature conditions of distribution and serving, the growth of *Listeria monocytogenes*, *Salmonella* and psychrotrophic *Clostridium botulinum* can be predicted. Based on these predictions, the tool determines whether any of the lag times have been exceeded during the total preparation, distribution and serving time. All underlying growth models use a "worst case" ingredient identified as cooked, sliced chicken.

Danish hygiene guidelines (nr. 9025 af 17/01/2013, afsnit 26.3) Violation of the cold chain

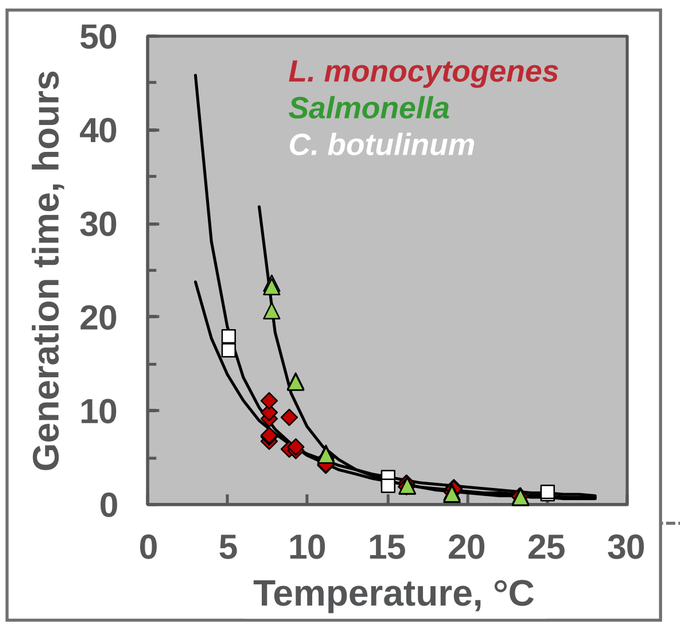
- As per the guidelines, chilled foods should not be outside the cold chain for more than 3 hours, including the time for preparation and serving.
- A prolongation of the acceptable time outside the cold chain can be allowed if it can be documented that the prolongation does not result in any health risks.

Ex. growth curves

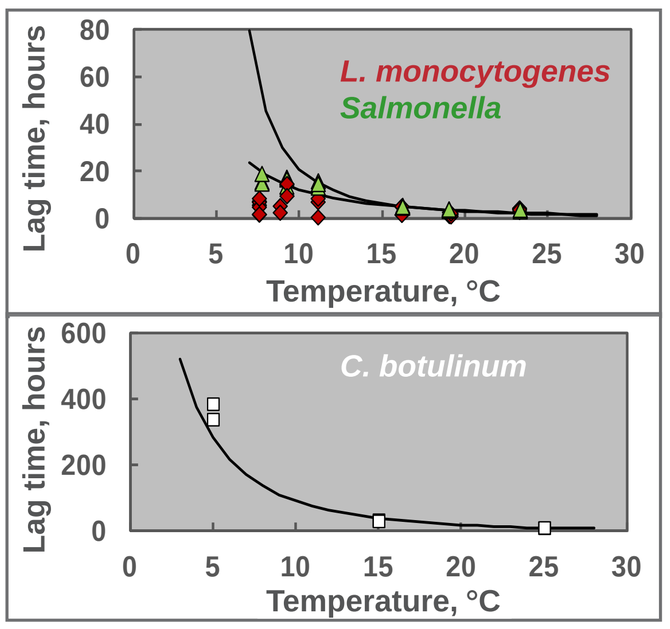




Constant conditions



Lag time may not be exceeded
lag time = RLT · generation time
RLT: relative lag time is a constant

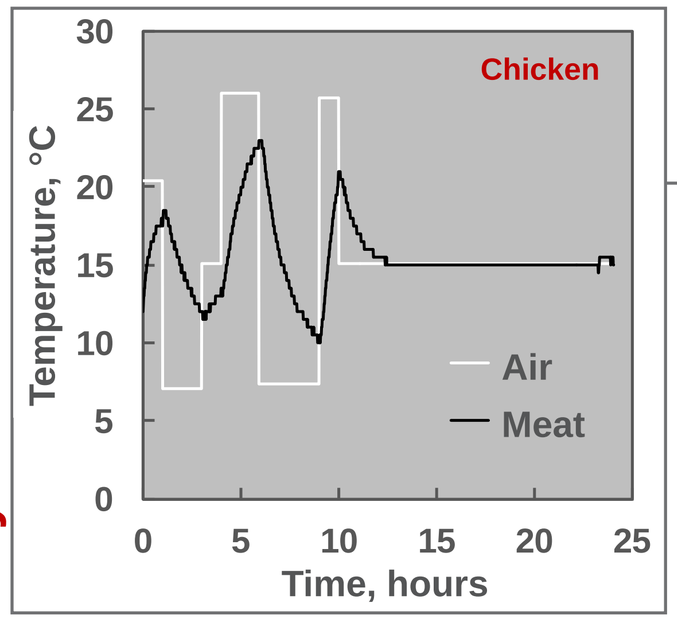


Continuous prediction of spent lag time, *N*

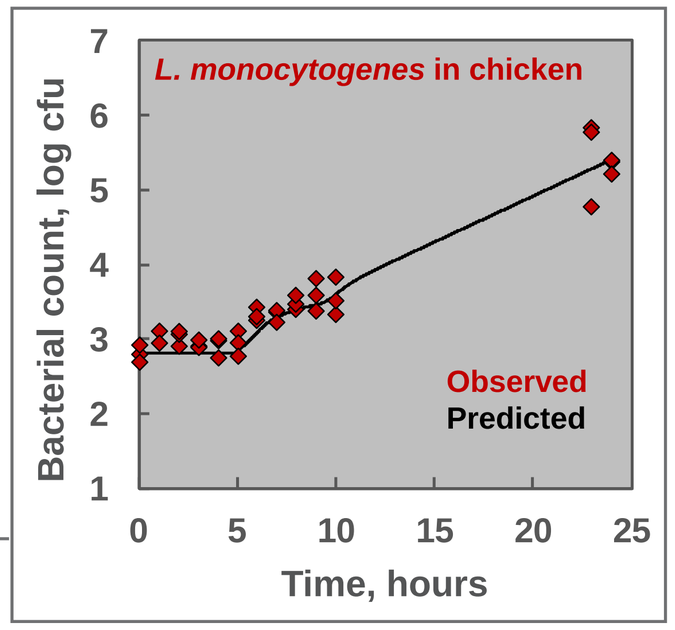
$$N(t) = \sum \frac{\ln(2)}{(b \cdot (T - T_{min}))^2} \cdot \frac{1}{\Delta t}$$

where *b* and T_{min} are constants, specific for each pathogen

Dynamic conditions



SAFE, if *N(t)* < RLT



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